

CLAIMS

What is Claimed is:

1. An engine exhaust particulate after-treatment system comprising exhaust particulate trapping means provided in an exhaust path of an engine for trapping particulates in exhaust gases, said engine exhaust particulate after-treatment system further comprising exhaust flow rate drop restriction means for restricting, on deceleration of the engine during the removal by burning of exhaust particulates trapped by the exhaust particulate trapping means, the drop of the flow rate of exhaust gases flowing into the exhaust particulate trapping means.
2. The engine exhaust particulate after-treatment system of Claim 1, further comprising:
 - deceleration detecting means for detecting a deceleration condition of the engine; and
 - operating condition detecting means for detecting an operating condition of the engine in which the exhaust gases are in such a high temperature range that the exhaust particulates trapped by the exhaust particulate trapping means can be removed by burning, wherein the exhaust flow rate drop restriction means is configured to restrict, on the detection of the deceleration condition of the engine when the engine operating condition in which the exhaust gases are in the high temperature range is detected, the drop of the flow rate of exhaust gases flowing into the exhaust particulate trapping means.
3. The engine exhaust particulate after-treatment system of Claim 2, further comprising:
 - an exhaust gas recirculation path for communicating part of the exhaust path upstream of the exhaust particulate trapping means with an intake path of the engine;
 - an exhaust gas recirculation valve disposed in the exhaust gas recirculation path;
 - exhaust gas recirculation amount setting means for setting the amount of

recirculation of exhaust gases through the exhaust gas recirculation valve according to the operating condition of the engine; and

exhaust gas recirculation amount compensation means for compensating the amount of recirculation of exhaust gases set by the exhaust gas recirculation amount setting means,

wherein the exhaust flow rate drop restriction means is formed by the exhaust gas recirculation amount compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the exhaust gas recirculation amount compensation means subtractively compensates for the amount of recirculation of exhaust gases set by the exhaust gas recirculation amount setting means.

4. The engine exhaust particulate after-treatment system of Claim 2, further comprising:

an intake throttle valve disposed in an intake path of the engine;

intake throttle valve opening setting means for setting the opening of the intake throttle valve according to the operating condition of the engine; and

intake throttle valve opening compensation means for compensating for the opening of the intake throttle valve set by the intake throttle valve opening setting means,

wherein the exhaust flow rate drop restriction means is formed by the intake throttle valve opening compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the intake throttle valve opening compensation means compensates for the opening of the intake throttle valve, which is controlled according to the engine operating condition, to become wider.

5. The engine exhaust particulate after-treatment system of Claim 2, further comprising:

fuel injection means for injecting fuel into a combustion chamber of the engine;

fuel injection cutoff means for cutting off fuel injection of the fuel injection means when a deceleration condition of the engine is detected by the deceleration detecting means; and

fuel injection cutoff inhibition means for inhibiting the operation of the fuel injection cutoff means,

wherein the exhaust flow rate drop restriction means is formed by the fuel injection cutoff inhibition means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the fuel injection cutoff inhibition means inhibits the fuel injection cutoff means from cutting off fuel injection.

6. The engine exhaust particulate after-treatment system of Claim 2, further comprising:

an automatic transmission;

gear ratio setting means for setting the gear ratio of the automatic transmission based on predetermined shift lines according to the running conditions of a vehicle; and

shift line compensation means for compensating for the shift lines of the gear ratio setting means,

wherein the exhaust flow rate drop restriction means is formed by the shift line compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the shift line compensation means compensates for the shift lines of the gear ratio setting means to a higher vehicle speed side.

7. The engine exhaust particulate after-treatment system of Claim 2, further comprising:

an automatic transmission;

gear ratio setting means for setting the gear ratio of the automatic transmission based on predetermined shift lines according to the running conditions of a vehicle; and

gear ratio compensation means for compensating for the gear ratio set by the gear ratio setting means,

wherein the exhaust flow rate drop restriction means is formed by the gear ratio compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the gear ratio compensation means compensates for the gear ratio set by the gear ratio setting means to a lower-speed stage side.

8. The engine exhaust particulate after-treatment system of Claim 2, further comprising:

an automatic transmission;

slip amount setting means for setting the slip amount between input and output members of a fluid coupling equipped with the automatic transmission according to the running conditions of a vehicle; and

slip amount compensation means for compensating for the slip amount set by the slip amount setting means,

wherein the exhaust flow rate drop restriction means is formed by the slip amount compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the slip amount compensation means additively compensates for the slip amount set by the slip amount setting means.

9. The engine exhaust particulate after-treatment system of Claim 1, further comprising:

exhaust particulate amount detecting means for directly or indirectly detecting the amount of exhaust particulate trapped by the exhaust particulate trapping means;

regeneration means for removing exhaust particulates trapped by the exhaust particulate trapping means by burning when the amount of exhaust particulate detected by the exhaust particulate amount detecting means reaches a predetermined value; and

deceleration detecting means for detecting a deceleration condition of the engine,
wherein the exhaust flow rate drop restriction means is configured to restrict, when
a deceleration condition of the engine is detected during the removal by burning of exhaust
particulates by the regeneration means, the drop of the flow rate of exhaust gases flowing
5 into the exhaust particulate trapping means.

10. The engine exhaust particulate after-treatment system of Claim 9, further comprising:

an exhaust gas recirculation path for communicating part of the exhaust path
upstream of the exhaust particulate trapping means with an intake path of the engine;

10 an exhaust gas recirculation valve disposed in the exhaust gas recirculation path;

exhaust gas recirculation amount setting means for setting the amount of
recirculation of exhaust gases through the exhaust gas recirculation valve according to the
operating condition of the engine; and

15 exhaust gas recirculation amount compensation means for compensating the
amount of recirculation of exhaust gases set by the exhaust gas recirculation amount
setting means,

wherein the exhaust flow rate drop restriction means is formed by the exhaust gas
recirculation amount compensation means, and when a deceleration condition of the engine
is detected by the deceleration detecting means during the removal by burning of exhaust
20 particulates, the exhaust gas recirculation amount compensation means subtractively
compensates for the amount of recirculation of exhaust gases set by the exhaust gas
recirculation amount setting means.

11. The engine exhaust particulate after-treatment system of Claim 10, further comprising:

25 an intake throttle valve disposed in an intake path of the engine;

intake throttle valve opening setting means for setting the opening of the intake
throttle valve according to the operating condition of the engine; and

intake throttle valve opening compensation means for compensating for the opening of the intake throttle valve set by the intake throttle valve opening setting means,

wherein the exhaust flow rate drop restriction means is formed by the exhaust gas recirculation amount compensation means and the intake throttle valve opening compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the intake throttle valve opening compensation means compensates for the opening of the intake throttle valve, which is controlled according to the engine operating condition, to become wider.

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12. The engine exhaust particulate after-treatment system of Claim 11, further comprising:

fuel injection means for injecting fuel into a combustion chamber of the engine;

fuel injection cutoff means for cutting off fuel injection of the fuel injection means when a deceleration condition of the engine is detected by the deceleration detecting means; and

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fuel injection cutoff inhibition means for inhibiting the operation of the fuel injection cutoff means,

wherein the exhaust flow rate drop restriction means is formed by the exhaust gas recirculation amount compensation means, the intake throttle valve opening compensation means and the fuel injection cutoff inhibition means, and the fuel injection cutoff inhibition means is configured, when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, to inhibit the fuel injection cutoff means from cutting off fuel injection.

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25 13. The engine exhaust particulate after-treatment system of Claim 10, further comprising:

fuel injection means for injecting fuel into a combustion chamber of the engine;

fuel injection cutoff means for cutting off fuel injection of the fuel injection means

when a deceleration condition of the engine is detected by the deceleration detecting means; and

fuel injection cutoff inhibition means for inhibiting the operation of the fuel injection cutoff means,

5 wherein the exhaust flow rate drop restriction means is formed by the exhaust gas recirculation amount compensation means and the fuel injection cutoff inhibition means, and the fuel injection cutoff inhibition means is configured, when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, to inhibit the fuel injection cutoff means from cutting off
10 fuel injection.

14. The engine exhaust particulate after-treatment system of Claim 10, further comprising:

an automatic transmission;

gear ratio setting means for setting the gear ratio of the automatic transmission
15 based on predetermined shift lines according to the running conditions of a vehicle; and

shift line compensation means for compensating for the shift lines of the gear ratio setting means,

wherein the exhaust flow rate drop restriction means is formed by the exhaust gas recirculation amount compensation means and the shift line compensation means, and the
20 shift line compensation means is configured, when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, to compensate for the shift lines of the gear ratio setting means to a higher vehicle speed side.

25 **15.** The engine exhaust particulate after-treatment system of Claim 9, further comprising:

an intake throttle valve disposed in an intake path of the engine;

intake throttle valve opening setting means for setting the opening of the intake

throttle valve according to the operating condition of the engine; and

intake throttle valve opening compensation means for compensating for the opening of the intake throttle valve set by the intake throttle valve opening setting means,

wherein the exhaust flow rate drop restriction means is formed by the intake
5 throttle valve opening compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the intake throttle valve opening compensation means compensates for the opening of the intake throttle valve, which is controlled according to the engine operating condition, to become wider.

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16. The engine exhaust particulate after-treatment system of Claim 9, further comprising:

fuel injection means for injecting fuel into a combustion chamber of the engine;

fuel injection cutoff means for cutting off fuel injection of the fuel injection means
when a deceleration condition of the engine is detected by the deceleration detecting
15 means; and

fuel injection cutoff inhibition means for inhibiting the operation of the fuel injection cutoff means,

wherein the exhaust flow rate drop restriction means is formed by the fuel injection cutoff inhibition means, and when a deceleration condition of the engine is detected by the
20 deceleration detecting means during the removal by burning of exhaust particulates, the fuel injection cutoff inhibition means inhibits the fuel injection cutoff means from cutting off fuel injection.

17. The engine exhaust particulate after-treatment system of Claim 9, further comprising:

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an automatic transmission;

gear ratio setting means for setting the gear ratio of the automatic transmission based on predetermined shift lines according to the running conditions of a vehicle; and

shift line compensation means for compensating for the shift lines of the gear ratio setting means,

wherein the exhaust flow rate drop restriction means is formed by the shift line compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the shift line compensation means compensates for the shift lines of the gear ratio setting means to a higher vehicle speed side.

18. The engine exhaust particulate after-treatment system of Claim 9, further comprising:

an automatic transmission;

gear ratio setting means for setting the gear ratio of the automatic transmission based on predetermined shift lines according to the running conditions of a vehicle; and

gear ratio compensation means for compensating for the gear ratio set by the gear ratio setting means,

wherein the exhaust flow rate drop restriction means is formed by the gear ratio compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the gear ratio compensation means compensates for the gear ratio set by the gear ratio setting means to a lower-speed stage side.

19. The engine exhaust particulate after-treatment system of Claim 9, further comprising:

an automatic transmission;

slip amount setting means for setting the slip amount between input and output members of a fluid coupling equipped with the automatic transmission according to the running conditions of a vehicle; and

slip amount compensation means for compensating for the slip amount set by the slip amount setting means,

wherein the exhaust flow rate drop restriction means is formed by the slip amount compensation means, and when a deceleration condition of the engine is detected by the deceleration detecting means during the removal by burning of exhaust particulates, the slip amount compensation means additively compensates for the slip amount set by the slip amount setting means.

20. An engine exhaust particulate after-treatment system, comprising:

a filter provided in an exhaust path of an engine for trapping particulates in exhaust gases;

10 a sensor for detecting the amount of exhaust particulate trapped by the filter;

an exhaust gas recirculation path for communicating part of the exhaust path upstream of the filter with an intake path of the engine;

an exhaust gas recirculation valve disposed in the exhaust gas recirculation path;

an injector for injecting fuel directly into a combustion chamber of the engine;

15 a deceleration sensor for detecting a deceleration condition of the engine; and

a control unit for controlling the operations of the injector and the exhaust gas recirculation valve using a computer,

wherein the control unit controls the injector to carry out a main injection of fuel in the vicinity of the top dead center on the compression stroke to obtain engine power,

20 wherein when the amount of exhaust particulate detected by the sensor reaches a predetermined value, the control unit controls the injector to carry out a post-injection of fuel after the main injection to raise the temperature of exhaust gases for the burning of exhaust particulates trapped by the filter,

wherein the control unit sets the amount of recirculation of exhaust gases according to the operating condition of the engine to operate the exhaust gas recirculation valve; and

wherein when a deceleration condition of the engine is detected by the deceleration

sensor during the execution of the post-injection, the control unit compensates for the set amount of recirculation of exhaust gases subtractively to control the exhaust gas recirculation valve to restrict the drop of the flow rate of exhaust gases flowing into the filter.